

Southwest Lower Michigan Winter 2009-2010 Forecast

By William Marino

Forecast Overview

The National Weather Service 2009-2010 winter forecast for Southwest Lower Michigan has an equal chance for the temperature and snowfall to be above normal, near normal or below normal. Precipitation is expected to be below normal.

Normals

Table 1. December through February normals for the 1971 to 2000 period for various winter parameters at climate sites in Southwest Lower Michigan.

Location		Grand Rapids	Muskegon	Lansing
Temperature	High	32°F	32°F	32°F
	Low	18°F	19°F	16°F
	Mean	25°F	26°F	24°F
Number of Days	High Below Freezing	55	53	55
	Low Below Freezing	142	139	149
Precipitation	Total for Season	6.27"	6.44"	5.23"
	Number of days \geq 0.01"	44	47	40
	Number of days \geq 0.50"	3	2	2

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Location		Grand Rapids	Muskegon	Lansing
Snowfall (July 1 st -June 30 th)	Normal Total	72.2"	105.5"	54.5"
	Mean Date of First 1"	11/17	11/17	11/20
	Mean Date of First 3"	12/02	11/29	12/10
	# of Days with 1" or more	20	29	17
	#of Days with 3" or more	7	12	4
	# of Days with 6" or more	1	3	1

Impacts on the winter of 2009-2010

Current El Niño conditions are expected to strengthen and persist into the northern hemisphere winter of 2009-10. The impact of El Niño on the climate over Southwest Lower Michigan is expected to be greatest during the winter season. A moderate strength El Niño is most likely during the winter, although either a stronger or weaker event also remains possible. Uncertainty in the future strength and duration of this event is considered in the winter forecast.

Based on the model forecast sea surface temperature (SST) anomalies, El Niño is expected to peak late in the fall or early winter. It is unusual for a moderate or strong El Niño event to peak so early in the season. Of the other strong El Niño events, about half of them peaked in the late winter or early spring. These events occurred in 1957, 1982, 1986, and 1991.

Warm winters typically follow moderate or strong El Niño events that peak during the winter. This occurred with the 1982/1983 event (Figure 1), when the winter temperature

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averaged 6.6 degrees above normal. However, an El Niño that peaks in the fall can be associated with below normal temperatures. This happened during the winter of 2002/2003, when temperatures averaged 2.6 degrees below normal (Figure 2).

Typically, moderate or stronger El Niño events result in warmer than normal temperatures over Southwest Lower Michigan (Figure 3). However, as discussed, an earlier peak can result in a colder than normal winter. Because there is uncertainty about when the current El Niño will peak, there is a chance this will not be the typical warm winter that would be expected for a moderate El Niño.

Temperature Outlook

In Southwest Lower Michigan, the typical winter outcome for all seventeen El Niños since 1950 was for temperatures to average warmer than normal (Figure 3). The mean temperature departure from normal for all seventeen winters was 0.7 degrees above normal. Of these winters that were influenced by El Niños, seven were warmer than normal, four were colder than normal, and five were near normal. Warmer than normal winters occurred in Southwest Lower Michigan nearly twice as often as cold winters when there was an El Niño occurring.

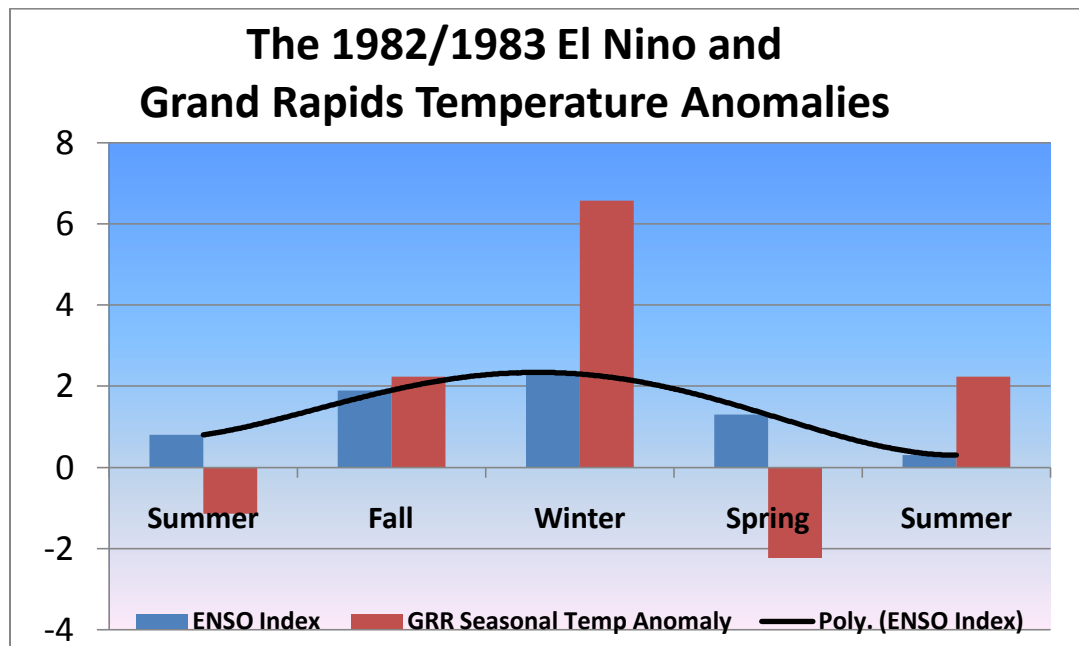


Figure 1. The 1982/1983 El Niño event comparing the temperature anomaly by season at Grand Rapids to strength of ENSO during that season.

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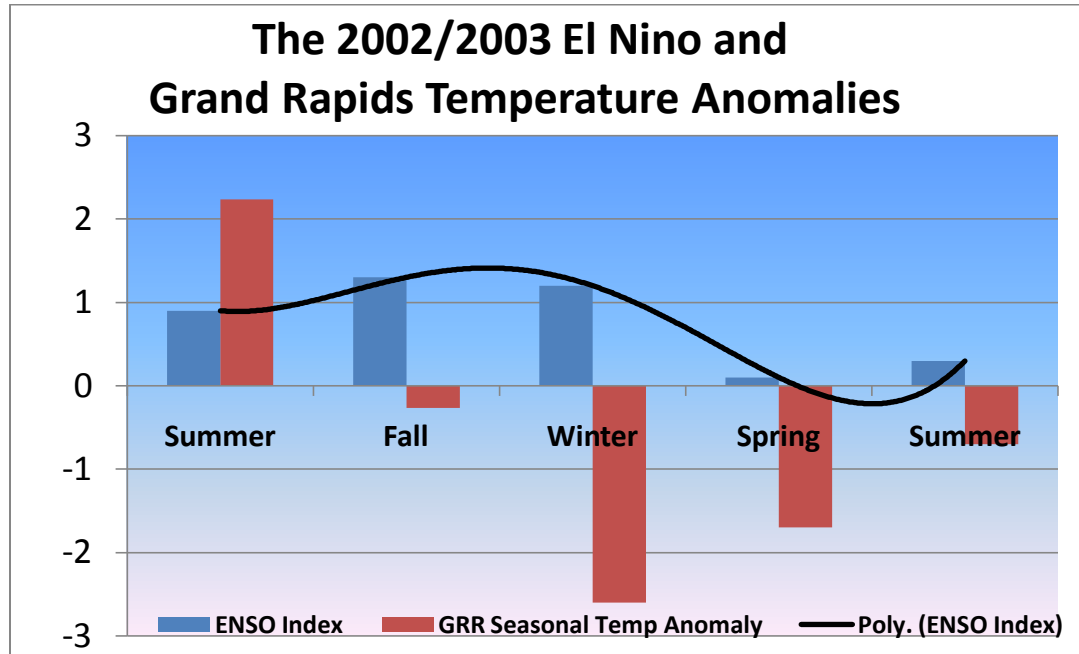


Figure 2. As in Figure 1, except for the 2002/2003 season.

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The other significant aspect seen in Figure 3 (middle left) is the trend toward warmer winters. During the past ten years, five winters were warmer than normal; two were colder than normal and three were near normal. However, the possible early weakening of the El Niño event may not lead to a warmer than normal winter, as we saw in the three winters with early El Niño peaks (1965-1966, 1972-1973 and 2002-2003).

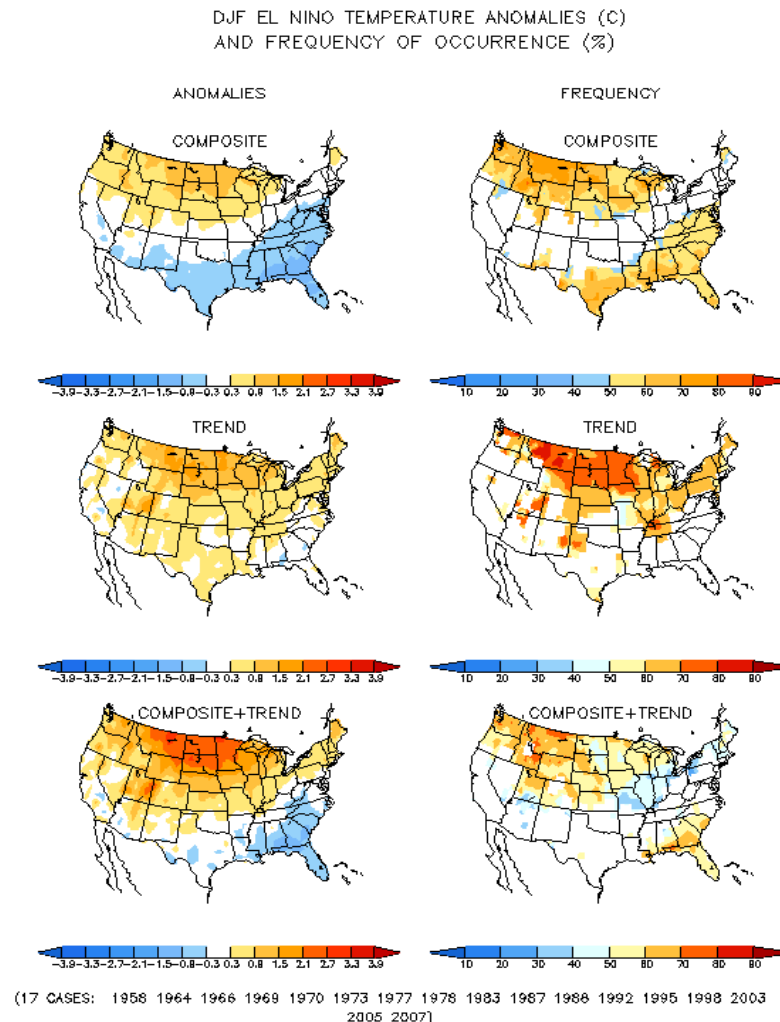


Figure 3. Composite and trend analyses of temperature anomalies done by the Climate Prediction Center for all seventeen El Niño events since 1950.

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Figure 4 displays the distribution of nine moderate to strong El Niños that have influenced our winters. Of the nine winters that occurred when El Niño was either in the moderate or strong state, five times out of nine the winter was warmer than normal. Only once was the winter colder than normal if El Niño was in the moderate or stronger state during the winter months (2002-2003). It is the outcome of the winter of 2002-2003 that is most relevant to the outcome of this coming winter's temperature anomaly.

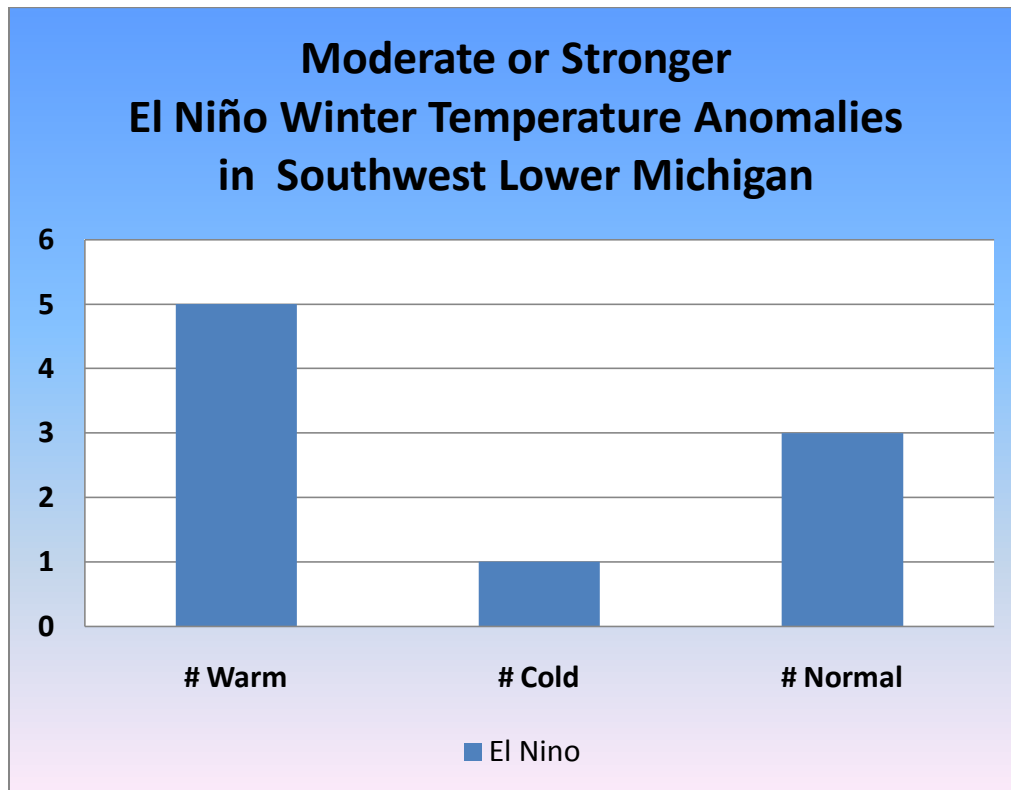


Figure 4. The average temperature anomaly for moderate or stronger El Niños for Southwest Lower Michigan.

If El Niño peaks too early in the season or is a weak event, the warm winter outcome no longer prevails; it is the colder than normal outcome with the greatest frequency (Figure 5). Looking at all seven winters in this group, three were colder than normal, two were warmer than normal, and two were near normal. This outcome suggests that there is a near equal chance for the above normal, near normal or below normal outcome for mean winter temperature anomaly. The mean winter temperature anomaly averaged 2.0 degrees above normal for all nine of our moderate or stronger El Niño winters. For winters with a weak El Niño or with one that peaked in the fall, the mean temperature anomaly was 1.2 degrees below normal. Both the strength and timing of El Niño events help to determine how warm of a winter Southwest Lower Michigan will experience.

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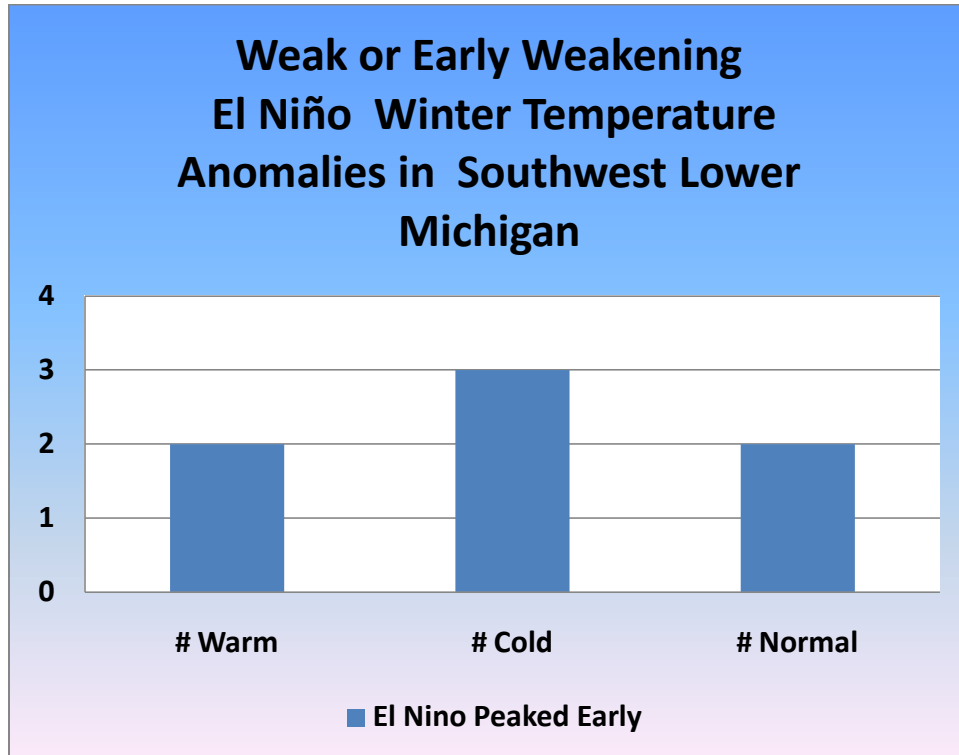


Figure 5. El Niño mean winter temperature anomaly when El Niño peaks in the fall or early winter.

Even though the typical El Niño winter is warmer than normal and there has been a trend toward warmer winters recently, the possible early peak of the current El Niño suggests the warmer than normal forecast might not work for this coming winter. As a result, our forecast for the winter of 2009-2010 is to have an equal chance for the mean winter temperature anomaly to be below normal, near normal or above normal.

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Precipitation Outlook

During El Niño winters, the most frequent outcome is a dry winter for Southwest Lower Michigan (Figure 6, upper left). However, there has been a trend toward wetter winters (Figure 6, middle left). If we consider both typical outcomes during the past seventeen El Niño winters since 1950 and then add the trend, near normal precipitation will most likely occur this winter (Figure 6, lower left).

DJF EL NINO PRECIPITATION ANOMALIES (MM)
AND FREQUENCY OF OCCURRENCE (%)

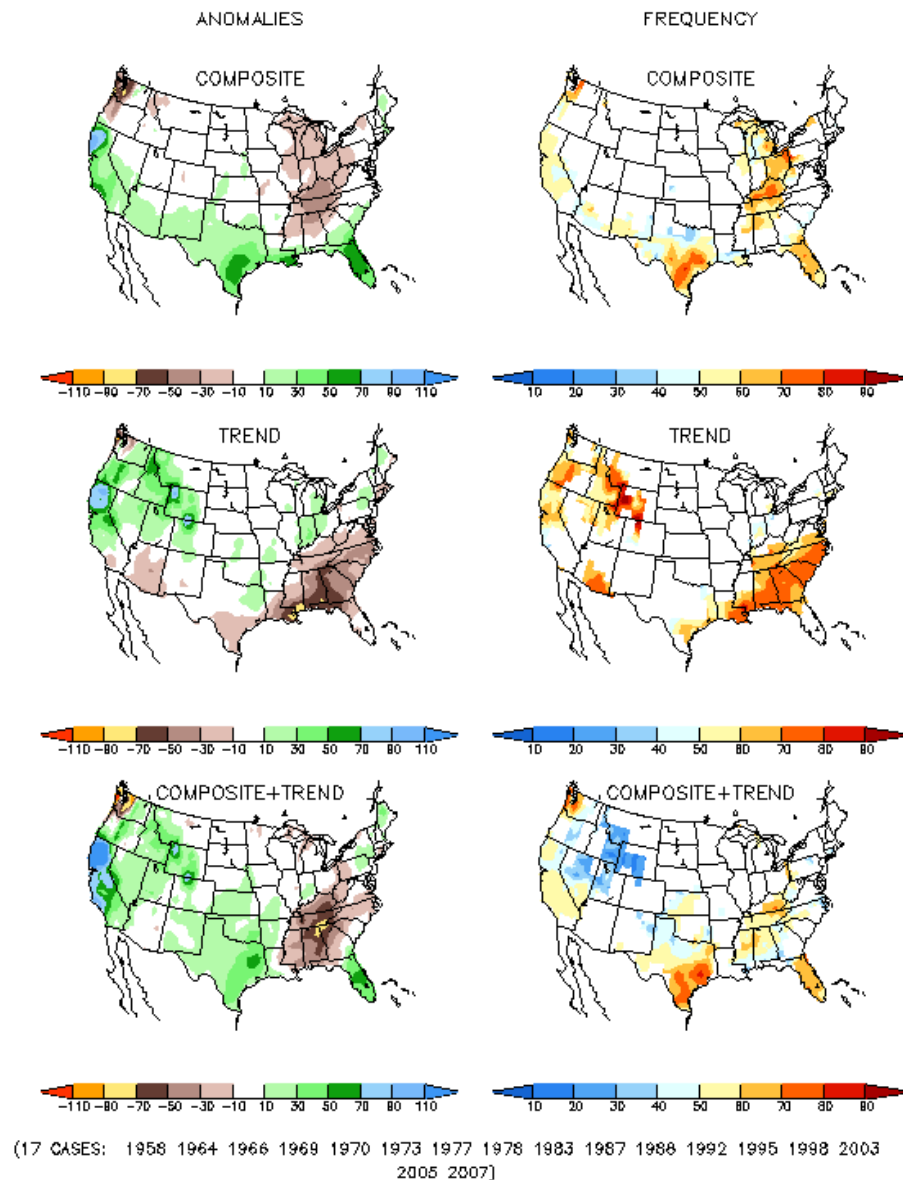


Figure 6. As in Figure 3, except for precipitation anomalies.

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Looking at only the moderate to strong El Niño winters, the outcome for precipitation anomalies for El Niño shows the near normal category had the greatest frequency (Figure 7). The near normal category dominated the outcomes for a moderate or stronger El Niño. Of the nine winters with moderate or strong El Niño events, five had near normal precipitation for all of Southwest Lower Michigan. Two winters had drier than normal anomalies and two winters had wetter than normal anomalies.

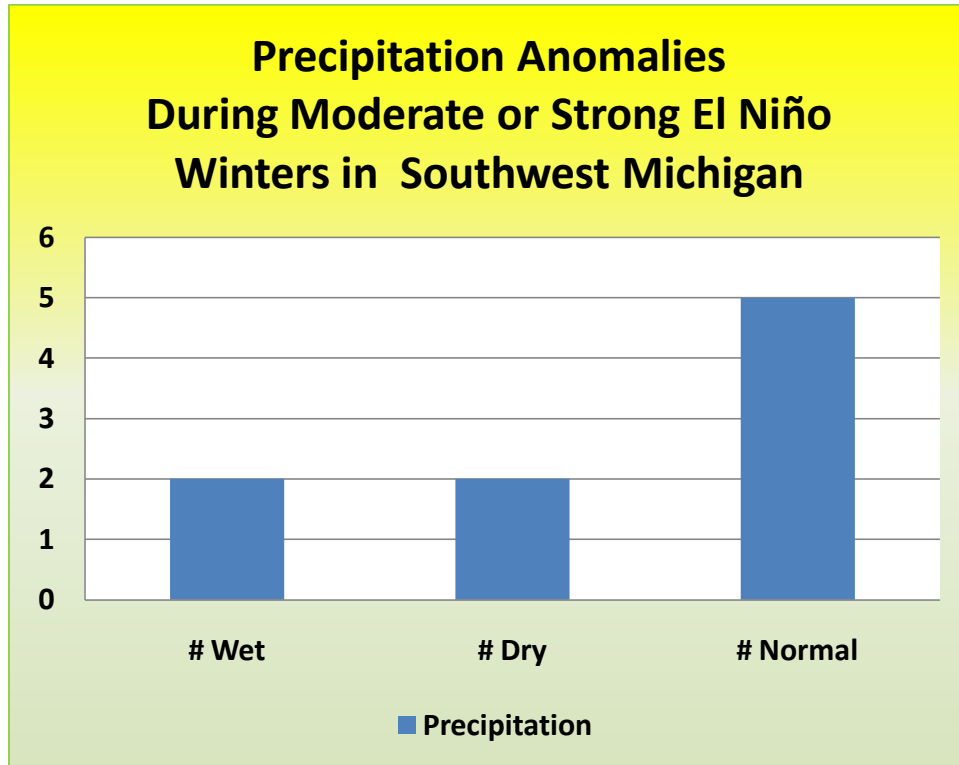


Figure 7. Precipitation anomalies in Southwest Lower Michigan for moderate or stronger El Niños.

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If El Niño weakens in the late fall or early winter or stays in the weak category, a dry winter is more likely (Figure 8). Since we expect an early demise of El Niño, the drier than normal forecast is favored based on El Niño considerations alone; however, recent trends indicate above normal precipitation. The forecast therefore is for equal chances of below normal, near normal, and above normal precipitation.

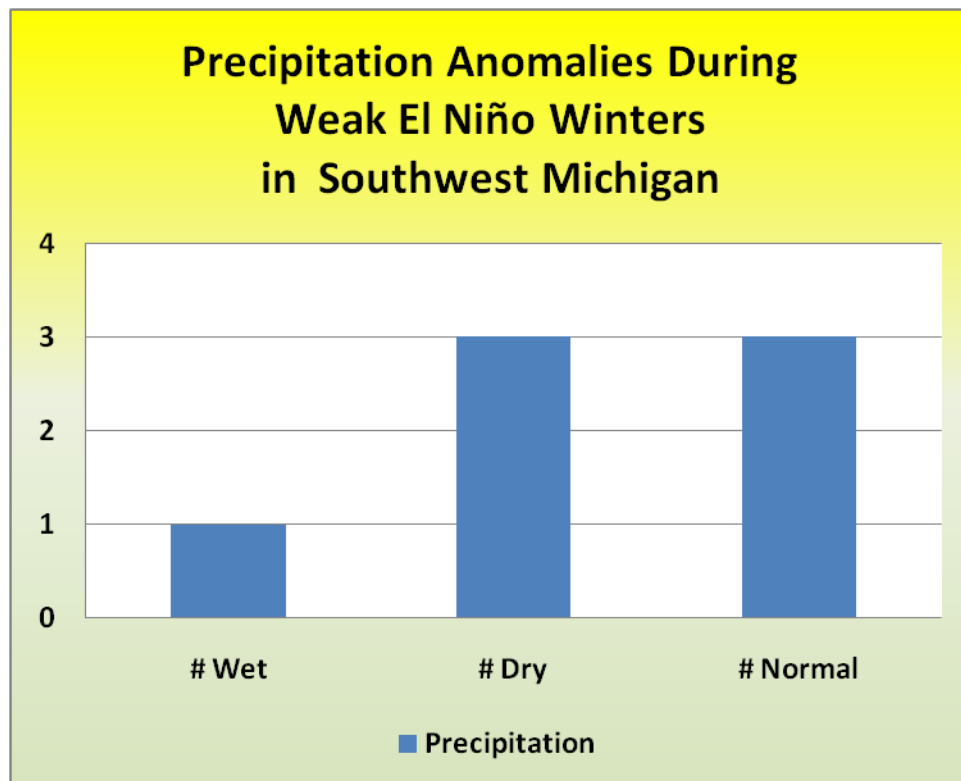


Figure 8. Seasonal Precipitation Anomaly for Southwest Lower Michigan when El Niño either peaked early or was weak through the Pacific Ocean.

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Snowfall Outlook

Like the precipitation forecast, the snowfall outlook features uncertainties. For the seventeen El Niño winters, below normal snowfall occurred most frequently (Figure 9). However, for our thirty-six long term climate stations, recent trends reveal above normal snowfall for most of the past ten years. Grand Rapids alone had above normal snowfall during eight out of the last ten years. The upward trend for snowfall is stronger than the upward trend is for precipitation. Based on trends alone, above normal snowfall still cannot be ruled out this winter. The snowfall anomalies composite chart suggests less snow than normal. Due to the mixed signals, the forecast is for an equal chance of above normal, near normal, or below normal snowfall.

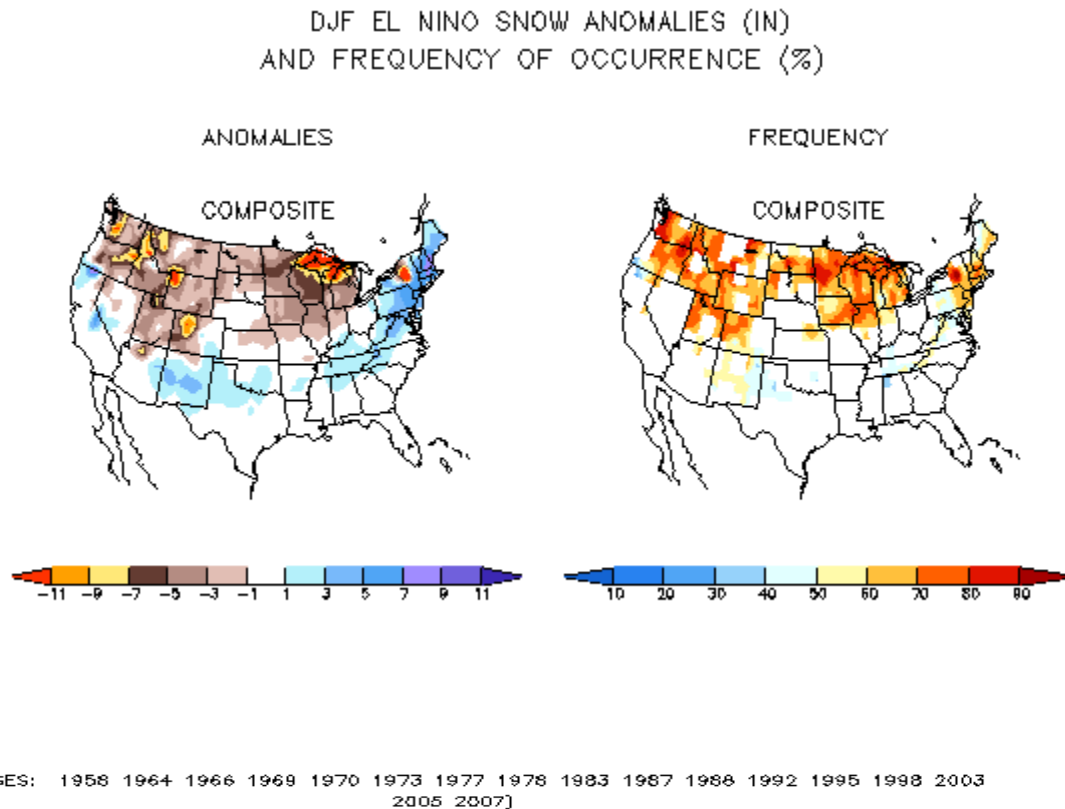


Figure 9. Composite analysis of snow anomalies and frequencies of seventeen El Niño events since 1950, as performed by the Climate Prediction Center.

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Summary

Both the state of El Niño and recent trends are the most critical factors in forecasting the type of winter Southwest Lower Michigan will experience. Despite the recent warm trend, the expectation that El Niño will peak during the early winter months in the moderate range results in an equal chance forecast for above, near, or below normal temperatures. Due to opposite signals from trends and composites of the years with at least a moderate El Niño, there is an equal chance for above normal, near normal, or below normal precipitation and snowfall.

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Useful Web Links

Climate Prediction Center Seasonal Forecast

<http://www.cpc.ncep.noaa.gov/products/predictions/90day/>

Climate Prediction Center Seasonal Forecast Discussion

<http://www.cpc.ncep.noaa.gov/products/predictions/90day/fxus05.html>

Climate Prediction Center Probability of Exceedance Map for the Winter

http://www.cpc.ncep.noaa.gov/products/predictions/long_range/poe_index.php?lead=03&var=t

Climate Prediction Center Probability La Niña Composite Maps (Item #32 on left side)

<http://www.cpc.ncep.noaa.gov/products/predictions/90day/tools/briefing/index.pri.html>

Climate Prediction Center Monitoring Page

http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_update/sstanim.shtml

Climate Prediction Center ENSO Monitoring Page

<http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/enso.shtml>

Climate Prediction Center Drought Monitor

<http://www.drought.unl.edu/dm/monitor.html>

Rutgers University Climate Lab, Global Snow Lab

http://climate.rutgers.edu/snowcover/table_area.php?ui_set=1

National Snow and Ice Data Center

<http://nsidc.org/index.html>

National Operational Hydrologic Remote Sensing Center

<http://www.nohrsc.nws.gov/>

El Niño Definition at Seasonal Forecast Discussion Glossary

<http://www.cpc.ncep.noaa.gov/products/predictions/90day/seasglossary.html#el%20nino>